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METAL-MINE ACCIDENTS

IN THE

UNITED STATES

DURING THE CALENDAR YEAR 1931

BY

WILLIAM W. ADAMS

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METAL-MINE ACCIDENTS IN THE UNITED STATES DURING THE CALENDAR YEAR 1931 [1] [2]

By WILLIAM W. ADAMS [3]

INTRODUCTION

During the calendar year 1931 the metal-mining industry in the United States established an all-time safety record in the prevention of nonfatal injuries among men employed at the mines and, except for 1928, also broke all previous records in the prevention of fatal accidents. While the number of men employed and the number of man-hours worked was smaller than in any previous year for which records are available, the number of deaths and injuries from accidents was reduced in even greater proportion. Thus, the industry progressed in the prevention of accidents notwithstanding the unfavorable economic situation that affected adversely nearly all branches of mining.

Compared with the preceding year the returns for 1931 showed declines of 22 percent in the number of men working at the mines and 33 percent in the volume of employment as measured by the total number of man-hours of exposure. The average period of operation was 231 days per man and represented a working year that was 39 days less per man than in 1930. Fatal accidents decreased 113 in number and nonfatal injuries 6,885 from the year before. The year's progress in accident prevention is indicated by the fact that the fatality rate per million man-hours of exposure, which was 1.17 in 1930, was lowered to 1.01 in 1931, and the nonfatal-injury rate, which was 67.07 in 1930, was reduced to 55.76.

Among 22 States that employed 1,000 or more men in the mining of metallic ores or nonmetallic minerals other than coal, Minnesota had the best safety record in the prevention of nonfatal injuries. The injury rate for mines in Minnesota was 12.86 per million man-hours of exposure, only about one fourth as high as the average rate for the United States. Virginia occupied first place in the prevention of fatalities, the returns from operators in that State indicating no deaths from accidents at metallic and nonmetallic mines; the injury rate for Virginia was almost identical with the average rate for the United States. Minnesota ranked next to Virginia in the prevention of fatal accidents, having a fatality rate of only 0.26 per million man-hours of exposure as compared with 1.01 for the United States as a whole.

Mining operations underground, considered as a separate class, also stripping and opencut mining and operations at surface shops and yards, reported lower fatality and injury rates than in the previous year.

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[1] Work on manuscript completed March 1933.

[2] The statistical canvass of the metal-mining industry and the work incident to the preparation of the statistical tables in this publication were conducted by Miss Mary Bringhurst, assisted by Mrs. M. E. Kolhos, of the Bureau of Mines.

[3] Chief statistician, demographical division, U.S. Bureau of Mines.

Among the five classes of mines covered in this publication, nonmetallic mineral mines reported the lowest fatal-accident rate while the lowest injury rate was reported by iron-ore mines. Lead and zinc mines in the Mississippi Valley States had the shortest working year—only 189 days per man—while copper mines, with 258 days per man, had the longest period of operation. Gold and silver mines reported 248 days of operation, only slightly less than the number reported by copper mines. All the principal classes of mines, however, worked fewer days per man than in 1930.

TABLE 1.—*Relative standing of States having 1,000 or more men employed at mines, in 1931, classified according to number of men employed and fatality and injury rates per million man-hours of labor performed*

Relative standing	State	Number of men employed	Relative standing	State	Fatality rate	Relative standing	State	Injury rate
1	Michigan	13,595	1	Virginia		1	Minnesota	12.86
2	Minnesota	8,332	2	Minnesota	0.26	2	Alabama	20.25
3	Arizona	6,848	3	Oklahoma	.35	3	Tennessee	20.99
4	California	5,553	4	Florida	.41	4	Florida	36.07
5	Montana	4,736	5	Missouri	.41	5	Michigan	39.95
6	Utah	3,962	6	Texas	.51	6	South Dakota	40.33
7	Idaho	3,911	7	Nevada	.62	7	Alaska	40.35
8	Alabama	3,528	8	Tennessee	.65	8	Texas	46.50
9	Alaska	3,125	9	New York	.73	9	Missouri	48.69
10	Missouri	3,005	10	Alaska	.84	10	Arizona	50.28
11	Colorado	2,506	11	Idaho	.90	11	Virginia	55.91
12	Nevada	2,144	12	Michigan	.91	12	Nevada	59.47
13	New Mexico	2,016	13	Utah	1.11	13	New Mexico	59.63
14	Oklahoma	1,793	14	South Dakota	1.30	14	NewJersey	68.71
15	Kansas	1,624	15	Arizona	1.32	15	Montana	72.47
16	Tennessee	1,557	16	California	1.39	16	New York	74.26
17	New York	1,530	17	Montana	1.41	17	Idaho	76.64
18	South Dakota	1,502	18	Alabama	1.51	18	Kansas	78.42
19	Texas	1,366	19	New Mexico	1.72	19	Utah	88.84
20	New Jersey	1,265	20	Colorado	1.80	20	California	107.85
21	Virginia	1,070	21	New Jersey	1.82	21	Oklahoma	108.57
22	Florida	1,044	22	Kansas	2.77	22	Colorado	112.01

TABLE 2.—*All mines: Number of active mines, men employed, man-days of labor, man-hours of labor, and number killed and injured, by kind of mine, during the year ended Dec. 31, 1931*

Kind of mine	Number of mines	Men employed				Days of labor				Man-hours			
		Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total
Copper	223	12,602	5,278	1,807	19,687	3,206,678	1,305,548	563,636	5,075,862	25,654,589	10,855,587	4,509,138	41,019,314
Gold, silver, and miscellaneous metal	2,514	15,878	7,697	768	24,343	4,062,909	1,849,478	126,299	6,038,686	32,594,782	14,889,038	1,148,902	48,632,722
Iron	201	11,868	5,464	4,454	21,786	2,395,369	1,134,195	878,136	4,407,700	19,925,313	10,570,041	8,625,671	39,121,025
Lead and zinc (Mississippi Valley)[1]	100	5,379	762	34	6,175	1,024,006	138,594	7,510	1,170,110	8,246,467	1,156,955	60,080	9,463,502
Nonmetallic mineral	328	2,596	3,303	3,050	8,949	549,532	903,959	575,637	2,029,128	4,678,318	7,933,131	5,329,847	17,941,296
Total	3,366	48,323	22,504	10,113	80,940	11,238,494	5,331,774	2,151,218	18,721,486	91,099,469	45,404,752	19,673,638	156,177,859

Kind of mine	Number killed				Number injured				Widows	Orphans	Rates per million man-hours								Average days active			
											Killed				Injured							
	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total			Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total
Copper	48	3		51	2,160	247	173	2,580	27	56	1.87	0.28		1.24	84.20	22.75	38.37	62.90	254	247	312	258
Gold, silver, and miscellaneous metal	56	2		58	3,119	679	27	3,825	28	45	1.72	.13		1.19	95.69	45.60	23.50	78.65	256	240	164	248
Iron	24	2	2	28	588	82	104	774	23	43	1.20	.19	0.23	.72	29.51	7.76	12.06	19.78	202	208	197	202
Lead and zinc (Mississippi Valley)[1]	10			10	648	41		689	6	4	1.21			1.06	78.58	35.44		72.81	190	182	221	189
Nonmetallic mineral	8	2	1	11	299	349	193	841	9	9	1.71	.25	19	.61	63.91	43.99	36.21	46.88	212	274	189	227
Total	146	9	3	158	6,814	1,398	497	8,709	93	157	1.60	.20	.15	1.01	74.80	30.79	25.26	55.76	233	237	213	231

[1] Includes fluorspar mines in Illinois and Kentucky.

As usual, falls of roof or wall were the principal cause of fatal as well as nonfatal accidents underground. Next in importance as a cause of fatalities were explosives accidents and accidents due to persons falling down chutes, winzes, raises, or stopes, each of these groups having 15 deaths in 1931. Next came accidents connected with loading rock or ore at the face, then haulage accidents, accidents caused by hand tools, drilling, and falls of persons down chutes, etc.

Accidents in shafts were caused chiefly by skips, cages, or buckets, or by objects or persons falling down shafts.

Only 3 fatalities at opencut mines were indicated by the operators' reports, and 2 of these resulted from falls or slides of rock or overburden. Chief among the causes of nonfatal injuries at the mines were handling materials, falls or slides of rock or ore, and falls of persons.

Among employees at surface shops and yards the largest number of accidents was due to handling materials; other important causes were hand tools, falls of persons, and machinery.

For each fatal accident that occurred during the year there were 55 nonfatal injuries that disabled an employee for more than the remainder of the day on which the accident occurred.

Table 1 showed the relative standing of 22 mining States (1) according to the number of men employed at the mines, (2) according to fatality rates, and (3) according to the number of nonfatal lost-time injuries per million man-hours of exposure to mining hazards.

ACKNOWLEDGMENTS

The facts brought out statistically in this publication are made known through an examination of reports voluntarily furnished by mine-operating companies throughout the country. Were it not for this cooperation of the operators, it would be impossible to obtain comparable records of mine accidents in different States, because of the different bases on which such records are prepared for State purposes. As comparable records are essential to the study of safety in mines and are especially needed when basic mining conditions are similar in many States, special acknowledgment is made to the mining companies whose courtesy in furnishing reports of their operations has made possible the preparation of comparable records of accidents for the entire metal-mining industry.

RELATION OF STATISTICS TO CALENDAR YEAR

This and all other regular statistical reports published by the United States Bureau of Mines relate to calendar years. The data contained in this bulletin are intended to show the number of deaths and injuries resulting from accidents that occurred during the calendar year 1931. While every effort has been made to obtain complete figures covering accidents at all mines, it is possible that in a few cases the figures cover a fatality in 1931 that resulted from an accident that occurred late in 1930. No such cases, however, are known to the writer.

For accident-prevention studies, accidents should be charged to the year when they occurred, so that they may be studied in connection with the causes and conditions that produced them. The figures in this publication are intended to cover only deaths and injuries that resulted from accidents that occurred in 1931.

SCOPE OF STATISTICS

The tables in this paper are based on reports from 3,366 mines which were operated all or part of the year. Reports for mines in Alaska were furnished by the Territorial mine inspector and those for mines in California by the industrial commission of that State. Reports for all other States were received directly from the operating companies, except those for Arizona and Idaho; these were received from the companies through the offices of the State mine officials of those States. Reports for all States cover prospects as well as producing and nonproducing mines. It is believed that the figures published are reasonably complete for the metal-mining industry.

MINES CLASSIFIED

Tables on the following pages are arranged to represent five divisions of the mining industry, as follows:

Copper mines.—This group comprises all of the copper mines and prospects reported in operation in the various copper-producing States.

Gold, silver, and miscellaneous metal mines.—This group comprises gold mines (both lode and placer), silver mines, lead-silver mines, gold-silver mines, lead and zinc mines other than those in the Mississippi Valley, and the mines working ores of quicksilver, manganese, manganiferous iron, tungsten, vanadium, chromium, etc. Pyrite mines are included, as the cinder is used in some metallurgical works for its iron and copper content, and bauxite mines because bauxite is the main source of metallic aluminum.

Iron mines.—All iron mines are included in this group except those whose ores are valuable chiefly for their manganese content.

Lead and zinc mines (Mississippi Valley.)—This group comprises the lead and zinc mines of the Mississippi Valley only but also includes fluorspar mines in Illinois and Kentucky.

Nonmetallic mineral mines.—The nonmetallic mineral mines include those producing asbestos, asphaltum, barite, borax, emery, feldspar, flint, fluorspar (except in Illinois and Kentucky), garnet, graphite, gypsum, kaolin, lithia, magnesite, mica, mineral paint, phosphate rock, quartz, salt, soapstone, sulphur, talc, and tripoli. Coal mines are not included, and the records do not cover properties that produce stone, clay, or sand and gravel.

CLASSIFICATION OF INJURIES

Statistics of accidents at metal mines and all other mines except coal mines have been compiled by the Bureau of Mines since 1911. From 1911 to 1914, inclusive, the Bureau's classification of nonfatal injuries covered two groups: "Serious" injuries disabling a workman for more than 20 days and "slight" injuries causing disability not exceeding 20 days but lasting longer than the remainder of the day of accident. Beginning with 1915 and continuing through 1929 a "serious" injury, as the term was used in the Bureau's reports, signified a temporary injury disabling an employee for more than 14 days. Beginning with 1930, all temporary injuries have been included in a single group, each injury causing disability for more than the remainder of the day on which the accident occurred.

During the latest 5 years (1927 to 1931) for which figures are available, 96,415 injuries to employees at metal mines and nonmetallic mines (except coal) have been reported to the Bureau. Of this number, 1,404 (1.46 percent) caused the death of the injured employees, 89 (0.09 percent) resulted in permanent total disability, 2,295 (2.38 percent) caused permanent partial disability, and 92,627 (96.07 percent) were temporary injuries that disabled the employees for more than the remainder of the day on which the accident occurred. As more than 148,000,000 man-shifts of work were performed at the mines during the 5-year period, the foregoing percentage distribution of accidents may be accepted as typical of the severity of accidental injuries to metal-mine employees in the United States.

TABLE 3.—*All mines: Number of active mines, men employed, and number of man-days of labor, by States, during the year ended Dec. 31, 1931*

State	Number of mines	Men employed				Days of labor			
		Underground	Surface	Open-cut	Total	Underground	Surface	Open-cut	Total
Alabama	19	2,389	851	288	3,528	473,314	179,310	39,247	691,871
Alaska	527	945	2,180	-------	3,125	256,510	483,932	-------	740,442
Arizona	215	4,788	1,590	470	6,848	1,194,516	392,429	118,744	1,705,689
California	640	3,527	1,743	283	5,553	861,224	418,292	56,371	1,335,887
Colorado	269	1,903	542	61	2,506	481,227	134,116	8,530	623,873
Florida	14	-------	373	671	1,044	-------	95,589	150,733	246,322
Georgia	11	37	59	90	186	8,020	13,068	22,188	43,276
Idaho	456	2,956	903	52	3,911	651,807	173,716	7,409	832,932
Illinois	12	199	31	14	244	24,939	3,912	1,330	30,181
Iowa	8	103	23	21	147	16,011	4,327	3,801	24,139
Kansas	34	1,281	343	-------	1,624	190,846	66,113	-------	256,959
Kentucky	15	165	195	516	876	28,399	22,778	40,855	92,032
Michigan	71	8,718	4,576	301	13,595	1,753,593	941,678	57,949	2,753,220
Minnesota	84	3,329	1,520	3,483	8,332	705,265	318,603	694,317	1,718,185
Missouri	50	2,049	394	562	3,005	424,270	89,244	90,318	603,832
Montana	147	3,917	817	2	4,736	1,109,443	221,515	482	1,331,440
Nevada	159	1,303	494	347	2,144	365,164	143,317	96,863	605,344
New Jersey	8	960	301	4	1,265	215,681	55,775	1,200	272,656
New Mexico	66	992	566	458	2,016	278,932	169,734	133,966	582,632
New York	32	1,134	358	38	1,530	241,641	80,421	4,817	326,879
North Carolina	18	184	139	183	506	49,948	38,555	48,038	136,541
Oklahoma	33	1,588	133	72	1,793	312,810	27,024	14,797	354,631
Oregon	89	193	157	6	356	35,991	29,625	1,570	67,186
Pennsylvania	12	105	117	186	408	20,912	31,344	47,899	100,155
South Dakota	35	784	693	25	1,502	248,793	225,608	5,938	480,339
Tennessee	19	659	534	364	1,557	156,907	125,506	70,565	352,978
Texas	19	148	1,089	129	1,366	43,617	388,296	31,966	463,879
Utah	123	2,428	746	788	3,962	728,117	234,034	272,673	1,234,824
Virginia	16	317	499	254	1,070	85,393	106,203	48,784	240,380
Washington	86	257	124	45	426	52,699	23,332	10,658	86,689
Wisconsin	8	475	202	4	681	127,309	56,425	600	184,334
Wyoming	31	106	80	25	211	13,684	9,696	2,590	25,970
Other States	40	384	132	371	887	81,512	28,257	66,020	175,789
Total	3,366	48,323	22,504	10,113	80,940	11,238,494	5,331,774	2,151,218	18,721,486

TABLE 4.—*All mines: Number of man-hours of labor and average days active, by States, during the year ended December 31, 1931*

State	Man-hours of labor				Average days active			
	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total
Alabama	4,480,376	1,744,160	392,470	6,617,006	198	211	136	196
Alaska	2,052,080	3,871,456	----------	5,923,536	271	222	--------	237
Arizona	9,553,132	3,140,104	949,952	13,643,188	249	247	253	249
California	6,896,204	3,401,865	457,424	10,755,493	244	240	199	241
Colorado	3,848,972	1,073,048	68,240	4,990,260	253	247	140	249
Florida	----------	951,944	1,515,489	2,467,433	--------	256	225	236
Georgia	80,200	130,680	222,060	432,940	217	221	247	233
Idaho	5,223,211	1,385,499	59,272	6,667,982	221	192	142	213
Illinois	200,856	31,296	10,640	242,792	125	126	95	124
Iowa	128,088	34,726	30,408	193,222	155	188	181	164
Kansas	1,580,303	587,486	----------	2,167,789	149	193	--------	158
Kentucky	247,564	212,084	397,765	857,413	172	117	79	105
Michigan	14,100,746	8,514,864	560,833	23,176,443	201	206	193	203
Minnesota	5,646,195	3,018,739	6,962,706	15,627,640	212	210	199	206
Missouri	3,400,010	718,152	729,288	4,847,450	207	227	161	201
Montana	8,875,544	1,773,590	3,856	10,652,990	283	271	241	281
Nevada	2,921,312	1,146,536	774,904	4,842,752	280	290	279	282
New Jersey	1,725,448	462,440	9,600	2,197,488	225	185	300	216
New Mexico	2,232,656	1,357,872	1,071,728	4,662,256	281	300	293	289
New York	2,003,025	699,584	44,635	2,747,244	213	225	127	214
North Carolina	440,860	335,440	450,380	1,226,680	271	277	263	270
Oklahoma	2,502,480	216,466	127,199	2,846,145	197	203	206	198
Oregon	287,233	237,760	12,560	537,553	186	189	262	189
Pennsylvania	167,296	313,440	476,168	956,904	199	268	258	245
South Dakota	1,990,344	1,804,864	48,197	3,843,405	317	326	238	320
Tennessee	1,291,352	1,173,243	631,790	3,096,385	238	235	194	227
Texas	373,681	3,230,458	288,071	3,892,210	295	357	248	340
Utah	5,824,626	1,872,272	2,185,528	9,882,426	300	314	346	312
Virginia	706,370	916,563	451,798	2,074,731	269	213	192	225
Washington	422,117	195,163	85,264	702,544	205	188	237	203
Wisconsin	1,045,747	516,201	5,400	1,567,348	268	279	150	271
Wyoming	108,972	77,568	21,100	207,640	129	121	104	123
Other States	742,469	259,189	628,913	1,630,571	212	214	178	198
Total	91,099,469	45,404,752	19,673,638	156,177,859	233	237	213	231

TABLE 5.—*All mines: Fatalities and injuries and rates per million man-hours, by States, during the year ended Dec. 31, 1931*

State	Number killed				Number injured (time lost, 1 day or more)				Widows	Orphans	Rates per million man-hours							
											Killed				Injured			
	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total			Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total
Alabama	9	1	--	10	110	15	9	134	10	16	2.01	0.57	----	1.51	24.55	8.60	22.93	20.25
Alaska	4	1	--	5	106	133	----	239	----	----	1.95	.26	----	.84	51.65	34.35	-----	40.35
Arizona	17	1	--	18	577	70	39	686	13	18	1.78	.32	----	1.32	60.40	22.29	41.05	50.28
California	15	----	--	15	968	171	21	1,160	8	6	2.18	----	----	1.39	140.37	50.27	45.91	107.85
Colorado	9	----	--	9	434	120	5	559	3	8	2.34	----	----	1.80	112.76	111.83	73.27	112.01
Florida	----	----	1	1	----	58	31	89	1	----	----	----	0.66	.41	----	60.93	20.46	36.07
Georgia	----	----	--	----	6	18	8	32	----	----	----	----	----	----	74.81	137.74	36.03	73.91
Idaho	6	----	--	6	430	80	1	511	3	2	1.15	----	----	.90	82.32	57.74	16.87	76.64
Illinois	1	----	--	1	7	1	----	8	1	----	4.98	----	----	4.12	34.85	31.95	-----	32.95
Iowa	----	----	--	----	9	2	----	11	----	----	----	----	----	----	70.26	57.59	-----	56.93
Kansas	6	----	--	6	153	17	----	170	2	4	3.80	----	----	2.77	96.82	28.94	-----	78.42
Kentucky	2	----	--	2	15	7	31	53	2	2	8.08	----	----	2.33	60.59	33.01	77.94	61.81
Michigan	19	2	--	21	823	100	3	926	18	36	1.35	.23	----	.91	58.37	11.74	5.35	39.95
Minnesota	3	----	1	4	108	25	68	201	4	7	.53	----	.14	.26	19.13	8.28	9.77	12.86
Missouri	1	----	1	2	194	12	30	236	2	----	.29	----	1.37	.41	57.06	16.71	41.14	48.69
Montana	15	----	--	15	728	44	----	772	1	8	1.69	----	----	1.41	82.02	24.81	-----	72.47
Nevada	3	----	--	3	190	50	48	288	1	----	1.03	----	----	.62	65.04	43.61	61.94	59.47
New Jersey	3	1	--	4	139	12	----	151	2	4	1.74	2.16	----	1.82	80.56	25.95	-----	68.71
New Mexico	8	----	--	8	167	31	80	278	4	12	3.58	----	----	1.72	74.80	22.83	74.65	59.63
New York	2	----	--	2	180	21	3	204	2	7	1.00	----	----	.73	89.86	30.02	67.21	74.26
North Carolina	----	----	--	----	55	29	27	111	----	----	----	----	----	----	124.76	86.45	59.95	90.49
Oklahoma	1	----	--	1	284	20	5	309	----	----	.40	----	----	.35	113.49	92.39	39.31	108.57
Oregon	----	----	--	----	4	21	----	25	----	----	----	----	----	----	13.93	88.32	-----	46.51
Pennsylvania	----	----	--	----	5	4	2	11	----	----	----	----	----	----	29.89	12.76	4.20	11.50
South Dakota	4	1	--	5	110	45	----	155	3	3	2.01	.55	----	1.30	55.27	24.93	-----	40.33
Tennessee	2	----	--	2	33	17	15	65	2	1	1.55	----	----	.65	25.55	14.49	23.74	20.99
Texas	1	1	--	2	18	155	8	181	2	7	2.68	.31	----	.51	48.17	47.98	27.77	46.50
Utah	10	1	--	11	801	56	21	878	7	10	1.72	.53	----	1.11	137.52	29.91	9.61	88.84
Virginia	----	----	--	----	49	51	16	116	----	----	----	----	----	----	69.37	55.64	35.41	55.91
Washington	1	----	--	1	37	8	----	45	----	----	2.37	----	----	1.42	87.65	40.99	-----	64.05
Wisconsin	1	----	--	1	28	2	----	30	----	1	.96	----	----	.64	26.78	3.87	-----	19.14
Wyoming	1	----	--	1	13	2	----	15	1	3	9.18	----	----	4.81	119.30	25.78	-----	72.24
Other States	2	----	--	2	33	1	26	60	1	1	2.69	----	----	1.23	44.45	3.86	41.34	36.80
Total	146	9	3	158	6,814	1,398	497	8,709	93	156	1.60	.20	.15	1.01	74.80	30.79	25.26	55.76

TABLE 6.—*All mines: Fatalities, by causes and States, during the year ended Dec. 31, 1931*

State [1]	Underground																	Shaft						
	Fall of rock or ore from roof or wall	Rock or ore while loading at working face	Hand tools	Explosives	Haulage	Falling down chute, winze, raise, or stope	Run of ore from chute or pocket	Drilling	Electricity	Machinery	Mine fires	Suffocation from natural gases	Inrush of water	Stepping on nail	Handling materials (other than rock or ore)	Other causes	Total, underground	Falling down shaft	Objects falling down shaft	Breaking of cables	Overwinding	Skip, cage, or bucket	Other causes	Total, shaft
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15a	15b		16	17	18	19	20	21	
Alabama	7					1	2										7	1				1		2
Alaska																1	4							
Arizona	7			5	3												15	2						2
California	7			2	1	3											13			2				2
Colorado	5					1						1					7		2					2
Florida																								
Idaho	2				1	1	1										5					1		1
Illinois																		1						1
Kansas	3			1												1	5	1						1
Kentucky	1																1		1					1
Michigan	5	1		4	1				1							1	13		1			5		6
Minnesota	2				1												3							
Missouri	1																1							
Montana	7	1	1		2	1										1	13					2		2
Nevada	1					1											2					1		1
New Jersey	1			1		1											3							
New Mexico	3			1													4	4						4
New York	1					1											2							
Oklahoma	1																1							
South Dakota	2			1		1											4							
Tennessee	1					1											2							
Texas	1																1							
Utah	4					2						1				1	8					1	1	2
Washington								1									1							
Wisconsin	1																1							
Wyoming						1											1							
Other States	2																2							
Total, 1931	65	2	1	15	9	15	3	1	1			2				5	119	9	4	2		11	1	27

[1] No fatalities reported in Florida, Georgia, Iowa, North Carolina, Oregon, Pennsylvania, and Virginia.

TABLE 6.—*All mines: Fatalities, by causes and States, during the year ended Dec. 31, 1931*—Continued

State	Surface												Opencut												Grand total
	Mine cars, mine locomotives, or aerial trams	Railway cars and locomotives	Run or fall of ore in or from ore bins	Falls of persons	Stepping on nail	Hand tools	Electricity	Machinery	Handling materials	Other causes	Total, surface	Falls or slides of rock or ore	Explosives	Haulage	Power shovels	Falls of persons	Falls of derricks, booms, etc.	Run or fall of ore in or from ore bins	Machinery	Electricity	Hand tools	Handling materials	Other causes	Total, open pit	
	22	23	24	25	26	27	28	29	30a	30b		31	32	33	34	35	36	37	38	39	40	41a	41b		
Alabama	1									1	1														10
Alaska										1	1														5
Arizona									1		1														18
California																									15
Colorado																									9
Florida																							1	1	1
Idaho																									6
Illinois																									1
Kansas																									6
Kentucky																									2
Michigan		1							1		2														21
Minnesota												1												1	4
Missouri												1												1	2
Montana																									15
Nevada																									3
New Jersey										1	1														4
New Mexico																									8
New York																									2
Oklahoma																									1
South Dakota										1	1														5
Tennessee																									2
Texas								1			1														2
Utah								1			1														11
Washington																									1
Wisconsin																									1
Wyoming																									1
Other States																									2
Total	1	1						2	2	3	9	2											1	3	158

TABLE 7.—*All mines: Injuries, by causes and States, during the year ended Dec. 31, 1931*

State	Underground																	Shaft						
	Fall of rock or ore from roof or wall	Rock or ore while loading at working face	Hand tools	Explosives	Haulage	Falling down chute, winze, raise, or stope	Run of ore from chute or pocket	Drilling	Electricity	Machinery	Mine fires	Suffocation from natural gases	Inrush of water	Stepping on nail	Handling materials (other than rock or ore)	Other causes	Total, underground	Falling down shaft	Objects falling down shaft	Breaking of cables	Overwinding	Skip, cage, or bucket	Other causes	Total, shaft
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15a	15b		16	17	18	19	20	21	
Alabama	11	9	14		30	1		2	1	9				2	7	20	106					3	1	4
Alaska	29	14	7	4	6	2	6	5	2					1		29	105					1		1
Arizona	147	28	44	10	61	32	8	35	2	12				30	46	106	561		5			4	7	16
California	201	98	110	20	122	109	32	82	3	9		4		10	68	75	943	4	5	3		13		25
Colorado	104	32	42	3	45	13	19	42	2	11		1		6	38	65	423	4	1			1	5	11
Florida																								
Georgia	3		3														6							
Idaho	111	58	50	3	28	24	3	19		4				16	34	56	406		6			5	13	24
Illinois	1	2			3											1	7							
Iowa	1	4			1											3	9							
Kansas	18	47	11		23	3	2	12		2				2	9	21	150	1					2	3
Kentucky	8	2												1	1	1	13	1				1		2
Michigan	179	99	39	11	74	46	64	57	1	8				12	33	123	746	6	25	1		13	32	77
Minnesota	27	3	3		11	5	3	2	1	3				2	14	30	104		1			1	2	4
Missouri	17	32	6	5	47	16	4	16	4	3				8	20	14	192		1				1	2
Montana	178	80	168	3	72	36		43						35	26	77	718	2				5	3	10
Nevada	29	31	21		15	12	20	19		1				7	4	28	187	1				1	1	3
New Jersey	20	27	17	4	9	5	15	14	2	2					5	16	136						3	3
New Mexico	51	16	19	2	21	4	13	18		2				5	8	5	164		1			1	1	3
New York	8	55	6		14	11	3	33	5	13				1	9	17	175	1				4		5
North Carolina	7	16	5		5	1		7							2	9	52	1				1	1	3
Oklahoma	31	74	6		50	8	2	21	2					1	2	79	276	1	5				2	8
Oregon	1		1		1	1											4							
Pennsylvania	1		1			1	1								1		5							
South Dakota	16	14		4	5		1	16		1						53	110							
Tennessee	5	4	2		3	2	5									12	33							
Texas	6	5	1		1	1		1								1	16	1	1					2
Utah	190	47	80	8	91	75	10	81	1	16		7		21	57	105	789		1		1	9	1	12
Virginia	2	17	6		4	1	3	8	1	1				1	1	4	49							
Washington	1	3	2		7		1	8		6					3	6	37							
Wisconsin	7	7			6			4								3	27						1	1
Wyoming	1	3		1			2			1				1	2	2	13							
Other States	9	5	2	1	6	1		2	1	2					1	3	33							
Total	1,420	832	666	79	761	410	217	547	28	106		12		162	391	964	6,595	23	52	4	1	63	76	219

TABLE 7.—*All mines: Injuries by causes and States, during the year ended Dec. 31, 1931*—Continued

State	Surface											Opencut													Grand total
	Mine cars, mine locomotives, or aerial trams	Railway cars and locomotives	Run or fall of ore in or from ore bins	Falls of persons	Stepping on nail	Hand tools	Electricity	Machinery	Handling materials	Other causes	Total, surface	Falls or slides of rock or ore	Explosives	Haulage	Power shovels	Falls of persons	Falls of derricks, booms, etc.	Run or fall of ore in or from ore bins	Machinery	Electricity	Hand tools	Handling materials	Other causes	Total, open pit	
	22	23	24	25	26	27	28	29	30a	30b		31	32	33	34	35	36	37	38	39	40	41a	41b		
Alabama	2				1	1		1	7	3	15			1	1						1	3	3	9	134
Alaska	6			18	4	25	3	13		64	133														239
Arizona	3	3	2	18	5	7	1	7	10	14	70	4		2	5	7	4		4		3	5	5	39	686
California	2		1	27	3	28	3	17	38	52	171	6		1	4	2			3			3	2	21	1,160
Colorado	9	1	2	7	1	16	1	18	25	40	120	3											2	5	559
Florida		4		8	4	4	4	12	7	15	58	1	2		4	5			4		3	2	10	31	89
Georgia	11					1			1	4	18	5				1						1	1	8	32
Idaho	3	1		12	3	11	1	7	19	23	80											1		1	511
Illinois	1										1														8
Iowa										2	2														11
Kansas		1		3	1			2	3	7	17														170
Kentucky				1	1				3	2	7	4		6	3	3	1		6		2	3	3	31	53
Michigan	3	5	8	20	1	12	1	9	6	35	100			1							2			3	926
Minnesota	1	2	2	4	3	1		1	5	6	25	4	3	7	2	8			8	1	7	21	7	68	201
Missouri			1			1		1	2	7	12	7		6		1			3		2	4	7	30	236
Montana	7			14	1	17	1		4		44														772
Nevada	3	2	1	3		6	1	6	7	21	50	13	2	1	1	8			1		5	12	5	48	288
New Jersey						4			1	7	12														151
New Mexico	1			4		3	1	1	10	11	31	17	2	4	3	9	1		3	2	4	15	20	80	278
New York	2	1	1	3		3		1	7	3	21			1					1				1	3	204
North Carolina	1	2	1	5	1	4		3	5	7	29	4	1			5	2					8	7	27	111
Oklahoma			1	1	1	2			4	11	20	1	1									3		5	309
Oregon			1	3		2		2	3	10	21														25
Pennsylvania	1	1					1		1		4		1								1			2	11
South Dakota				1				4		40	45														155
Tennessee	2		1	4		2		2	2	4	17				1	2	1	1			1	3	6	15	65
Texas			3	9	4	25	1	42	34	37	155	1		1						1	1	3	1	8	181
Utah	8		1	10	2	3	1	5	17	9	56	7		5		5			1			2	1	21	878
Virginia		2		9		9			9	22	51	2			1				1		1	1	10	16	116
Washington		1			1	3			1	2	8														45
Wisconsin						1				1	2														30
Wyoming				1				1			2														15
Other States				1							1	2	1	1		1		1	1		4	7	8	26	60
Total	66	26	26	186	37	191	20	156	234	456	1,398	81	13	37	25	57	9	2	36	4	37	97	99	497	8,709

TABLE 8.—*All mines: Accidents, by States and severity of injury, during the year ended Dec. 31, 1931*

State	Killed	Nonfatal			Total nonfatal	Grand total
		Permanent total [1]	Permanent partial [2]	Temporary [3]		
Alabama	10		23	111	134	144
Alaska	5	1	3	235	239	244
Arizona	18	2	20	664	686	704
California	15		23	1,137	1,160	1,175
Colorado	9	3	18	538	559	568
Florida	1		7	82	89	90
Georgia			1	31	32	32
Idaho	6	1	26	484	511	517
Illinois	1		1	7	8	9
Iowa				11	11	11
Kansas	6		3	167	170	176
Kentucky	2		3	50	53	55
Michigan	21	1	26	899	926	947
Minnesota	4		15	186	201	205
Missouri	2		35	201	236	238
Montana	15	1		771	772	787
Nevada	3		5	283	288	291
New Jersey	4	1	17	133	151	155
New Mexico	8	1	4	273	278	286
New York	2	1	9	194	204	206
North Carolina			1	110	111	111
Oklahoma	1		19	290	309	310
Oregon				25	25	25
Pennsylvania			3	8	11	11
South Dakota	5		3	152	155	160
Tennessee	2		3	62	65	67
Texas	2		3	178	181	183
Utah	11	1	16	861	878	889
Virginia			1	115	116	116
Washington	1			45	45	46
Wisconsin	1		1	29	30	31
Wyoming	1	1	2	12	15	16
Other States	2	1	1	58	60	62
Total	158	15	292	8,402	8,709	8,867

[1] Permanent total disability: Loss of both legs or arms, 1 leg and 1 arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

[2] Permanent partial disability: Loss of 1 foot, leg, arm, hand, eye, 1 or more fingers, 1 or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

[3] Disability for more than the remainder of day of accident.

TABLE 9.—*All mines: Accidents, by causes and severity of injury, during the year ended Dec. 31, 1931*

Cause of accident	Killed	Nonfatal				Grand total
		Permanent total [1]	Permanent partial [2]	Temporary [3]	Total nonfatal	
Underground:						
1. Fall of rock or ore from roof or wall	65	4	39	1,377	1,420	1,485
2. Rock or ore while loading at working face	2		31	801	832	834
3. Hand tools	1		20	646	666	667
4. Explosives	15	4	9	66	79	94
5. Haulage	9	1	46	714	761	770
6. Falling down chute, winze, raise, or stope	15	1	7	402	410	425
7. Run of ore from chute or pocket	3	1	8	208	217	220
8. Drilling	1		10	537	547	548
9. Electricity	1			28	28	29
10. Machinery			11	95	106	106
11. Mine fires						
12. Suffocation from natural gases	2			12	12	14
13. Inrush of water						
14. Stepping on nail			1	161	162	162
15a. Handling materials (other than rock or ore)			10	381	391	391
15b. Other causes	5		28	936	964	969
Total, underground	119	11	220	6,364	6,595	6,714
Shaft:						
16. Falling down shaft	9			23	23	32
17. Objects falling down shaft	4		2	50	52	56
18. Breaking of cables	2			4	4	6
19. Overwinding				1	1	1
20. Skip, cage, or bucket	11	1	2	60	63	74
21. Other causes	1	1	6	69	76	77
Total, shaft	27	2	10	207	219	246
Surface:						
22. Mine cars, mine locomotives, gravity or aerial trams	1		3	63	66	67
23. Railway cars and locomotives	1		2	24	26	27
24. Run or fall of ore in or from ore bins				26	26	26
25. Falls of persons		1	5	180	186	186
26. Stepping on nail				37	37	37
27. Hand tools			2	189	191	191
28. Electricity				20	20	20
29. Machinery	2	1	16	139	156	158
30a. Handling materials	2		2	232	234	236
30b. Other causes	3		6	450	456	459
Total, surface	9	2	36	1,360	1,398	1,407
Open pit:						
31. Falls or slides of rock or ore	2		1	80	81	83
32. Explosives			2	11	13	13
33. Haulage			3	34	37	37
34. Power shovels			2	23	25	25
35. Falls of persons			2	55	57	57
36. Falls of derricks, booms, etc				9	9	9
37. Run or fall of ore in or from ore bins				2	2	2
38. Machinery			9	27	36	36
39. Electricity				4	4	4
40. Hand tools			2	35	37	37
41a. Handling materials			1	96	97	97
41b. Other causes	1		4	95	99	100
Total, open pit	3		26	471	497	500
Grand total	158	15	292	8,402	8,709	8,867

[1] Permanent total disability: Loss of both legs or arms, 1 leg and 1 arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.
[2] Permanent partial disability: Loss of 1 foot, leg, hand, eye, 1 or more fingers, 1 or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.
[3] Disability for more than the remainder of day of accident.

TABLE 10.—*All mines: Causes of fatalities and injuries, showing percentage due to each cause and corresponding rates per million man-hours during the year ended Dec. 31, 1931*

Cause of accident	Number killed				Number injured			
	Percent of—		Per million man-hours		Percent of—		Per million man-hours	
	Grand total	Class total	Grand total	Class total	Grand total	Class total	Grand total	Class total
Underground:								
1. Fall of rock or ore from roof or wall	41.14	54.62	0.42	0.71	16.30	21.53	9.09	15.59
2. Rock or ore while loading at working face	1.27	1.68	.01	.02	9.55	12.61	5.33	9.13
3. Hand tools	.63	.84	.01	.01	7.65	10.10	4.26	7.31
4. Explosives	9.49	12.61	.09	.17	.91	1.20	.51	.87
5. Haulage	5.70	7.56	.06	.10	8.74	11.54	4.87	8.35
6. Falling down chute, winze, raise, or stope	9.49	12.61	.09	.17	4.71	6.22	2.63	4.50
7. Run of ore from chute or pocket	1.90	2.52	.02	.03	2.49	3.29	1.39	2.38
8. Drilling	.63	.84	.01	.01	6.28	8.29	3.50	6.01
9. Electricity	.63	.84	.01	.01	.32	.42	.18	.31
10. Machinery					1.22	1.61	.68	1.16
11. Mine fires								
12. Suffocation from natural gases	1.27	1.68	.01	.02	.14	.18	.08	.13
13. Inrush of water								
14. Stepping on nail					1.86	2.46	1.04	1.78
15a. Handling materials other than rock or ore					4.49	5.93	2.50	4.29
15b. Other causes	3.16	4.20	.03	.06	11.07	14.62	6.17	10.58
Total, underground	75.31	100.00	.76	1.31	75.73	100.00	42.23	72.39
Shaft:								
16. Falling down shaft	5.70	33.33	.06	.10	.26	10.50	.15	.25
17. Objects falling down shaft	2.53	14.82	.02	.05	.60	23.74	.33	.57
18. Breaking of cables	1.27	7.41	.01	.02	.05	1.83	.02	.05
19. Overwinding					.01	.46	.01	.01
20. Skip, cage, or bucket	6.96	40.74	.07	.12	.72	28.77	.40	.69
21. Other causes	.63	3.70	.01	.01	.87	34.70	.49	.83
Total, shaft	17.09	100.00	.17	.30	2.51	100.00	1.40	2.40
Surface:								
22. Mine cars, mine locomotives, gravity or aerial trams	.63	11.11	.01	.02	.76	4.72	.42	1.45
23. Railway cars and locomotives	.63	11.11	.01	.02	.30	1.86	.17	.57
24. Run or fall of ore in or from ore bins					.30	1.86	.17	.57
25. Falls of persons					2.13	13.30	1.19	4.10
26. Stepping on nail					.42	2.65	.24	.82
27. Hand tools					2.19	13.66	1.22	4.21
28. Electricity					.23	1.48	.12	.44
29. Machinery	1.27	22.22	.01	.05	1.79	11.16	1.00	3.44
30a. Handling materials	1.27	22.22	.01	.05	2.69	16.74	1.50	5.15
30b. Other causes	1.90	33.34	.02	.06	5.24	32.62	2.92	10.04
Total, surface	5.70	100.00	.06	.20	16.05	100.00	8.95	30.79
Open pit:								
31. Falls or slides of rock or ore	1.27	66.67	.01	.10	.93	16.30	.52	4.12
32. Explosives					.15	2.62	.08	.66
33. Haulage					.42	7.44	.24	1.88
34. Power shovels					.29	5.03	.16	1.27
35. Falls of persons					.65	11.47	.37	2.90
36. Falls of derricks, booms, etc					.10	1.81	.06	.46
37. Run or fall of ore in or from ore bins					.02	.40	.01	.10
38. Machinery					.42	7.24	.23	1.83
39. Electricity					.05	.81	.02	.20
40. Hand tools					.42	7.44	.24	1.88
41a. Handling materials					1.12	19.52	.62	4.93
41b. Other causes	.63	33.33	.01	.05	1.14	19.92	.63	5.03
Total, open pit	1.90	100.00	.02	.15	5.71	100.00	3.18	25.26
Grand total	100.00		1.01		100.00		55.76	

ACCIDENTS CLASSIFIED BY KIND OF MINE

Copper mines.—Mines whose output was valuable chiefly for the copper content of the ore experienced an increase of 9 percent in their fatality rate but accomplished a reduction of 21 percent in their frequency rate for nonfatal injuries. Considered as a single group the mines were active 258 days or 2,084 hours per man. The total volume of exposure was 41,019,314 man-hours for the 19,687 men employed. Accidents resulted in 51 deaths and 2,580 nonfatal lost-time injuries, the fatality rate being 1.24 and the injury rate 62.90 per million man-hours of exposure. The three principal copper-mining States from the standpoint of numbers of men employed were Michigan, Arizona, and Montana. Frequencies of fatal and nonfatal accidents per million man-hours worked at copper mines in these three States were 71.07 for Michigan, 52.15 for Arizona, and 76.45 for Montana, compared with a combined rate of 64.14 for all copper mines in the United States. The causes of accidents at copper mines and the number of employees injured or killed by each cause are shown in table 21, page 24. (See also tables 11 and 12.)

Gold and silver mines.—Mines of the gold-silver class, which includes mines producing metallic ores not included in the copper, iron, or lead-zinc groups, effected a 36 percent reduction in the fatality rate and a 21 percent reduction in the nonfatal-injury rate per million man-hours of exposure. The fatality rate was 1.19 and the injury rate 78.65. An average of 24,343 employees working during the year indicated no material change from the year before, but the average employee worked only 248 days compared with 269 days in 1930. The average employee was exposed to mining hazards 1,998 hours during 1931. The total volume of employment or exposure for all employees was 48,632,722 man-hours, a reduction of approximately 17 percent. States having the largest number of men employed in this class of mines, with their nonfatal injury rates per million man-hours of exposure, were California 105.90, Idaho 75.08, Alaska 36.38, Utah 124.29, and Colorado 137.33. Fifty-eight men were killed and 3,825 men injured by accidents during the year.

Iron mines.—Safety in mining has, perhaps, advanced further at iron-ore mines than at any other major class of metal mines. In 1931 the fatality rate per million man-hours was only 0.72 and the rate for nonfatal injuries only 19.78. These are unusually favorable rates for mining, and both represent further reductions from the favorable rates for iron mining that prevailed in 1930. The average period of operation of the mines was 202 days per man, a loss of 61 days from the previous year. The average number of men working during 1931 was 21,786 compared with 29,410 in 1930. A reduction of 43 percent was reported in the total volume of employment as measured by the number of man-hours worked during the year. Accidents at the mines resulted in 28 deaths and 774 nonfatal lost-time injuries, the causes of which are shown in table 21.

TABLE 11.—*Copper mines: Men employed and days of labor, by States, during the year ended Dec. 31, 1931*

State	Number of mines	Men employed				Days of labor				Average days active			
		Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total
Arizona	63	3,993	1,330	411	5,734	1,043,268	341,963	112,918	1,498,149	261	257	275	261
California	9	224	12	6	242	61,774	2,547	1,176	65,497	276	212	196	271
Idaho	23	49	11	6	66	6,963	1,287	1,345	9,595	142	117	224	145
Michigan	10	3,672	2,153		5,825	767,693	446,523		1,214,216	209	207		208
Montana	38	3,460	672		4,132	1,009,619	193,852		1,203,471	292	288		291
Nevada	14	267	235	301	803	82,362	71,327	85,440	239,129	308	304	284	298
New Mexico	18	278	348	411	1,037	79,358	101,283	120,233	300,874	285	291	293	290
Oregon	4	22	5		27	4,608	1,825		6,433	209	365		238
Utah	11	146	223	670	1,039	36,562	79,046	242,474	358,082	250	354	362	345
Washington	14	58	53		111	9,743	9,308		19,051	168	176		172
Other States	19	433	236	2	671	104,728	56,587	50	161,365	242	240	25	240
Total	223	12,602	5,278	1,807	19,687	3,206,678	1,305,548	563,636	5,075,862	254	247	312	258

TABLE 12.—*Copper mines: Number of man-hours of labor and number killed and injured, by States, during the year ended Dec. 31, 1931*

State	Man-hours of labor				Number killed				Number injured				Widows	Orphans
	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total		
Arizona	8,346,144	2,735,704	903,344	11,985,192	15	1		16	521	52	36	609	12	18
California	494,192	20,376	9,408	523,976	1			1	93	1		94		1
Idaho	56,344	10,296	10,760	77,400										
Michigan	6,141,544	3,974,880		10,116,424	12	1		13	635	71		706	12	27
Montana	8,076,952	1,550,816		9,627,768	14			14	681	41		722		
Nevada	658,896	570,616	683,520	1,913,032					41	23	39	103		
New Mexico	634,864	810,264	961,864	2,406,992	4			4	94	16	79	189	2	9
Oregon	36,864	14,600		51,464										
Utah	292,496	632,368	1,939,792	2,864,656					18	8	19	45		
Washington	78,469	82,971		161,440	1			1	9	5		14		
Other States	837,824	452,696	450	1,290,970	1	1		2	68	30		98	1	1
Total	25,654,589	10,855,587	4,509,138	41,019,314	48	3		51	2,160	247	173	2,580	27	56

TABLE 13.—*Gold, silver, and miscellaneous metal mines: Men employed and days of labor, by States, during the year ended Dec. 31, 1931*

State	Number of mines	Men employed				Days of labor				Average days active			
		Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total
Alaska	522	863	2,153		3,016	229,230	475,091		704,321	266	221		234
Arizona	146	686	231	18	935	134,938	45,805	2,307	183,050	197	198	128	196
California	572	2,989	1,627	144	4,760	721,052	388,062	26,207	1,135,321	241	239	182	239
Colorado	240	1,805	523	29	2,357	469,564	130,829	3,965	604,358	260	250	137	256
Idaho	426	2,791	875	46	3,712	617,106	167,219	6,064	790,389	221	191	132	213
Montana	102	391	137	2	530	79,835	25,205	482	105,522	204	184	241	199
Nevada	135	1,009	240	14	1,263	277,289	67,630	3,855	348,774	275	282	275	276
New Mexico	41	660	186	1	847	183,809	57,191	30	241,030	278	307	30	285
Oregon	85	171	152	6	329	31,383	27,800	1,570	60,753	184	183	262	185
South Dakota	29	777	693	6	1,476	246,693	225,608	1,878	474,179	317	326	313	321
Utah	91	2,175	476	17	2,668	668,055	144,566	3,075	815,696	307	304	181	306
Virginia	7	213	34	92	339	61,071	8,756	15,510	85,337	287	258	169	252
Washington	67	179	61	19	259	38,149	11,348	3,144	52,641	213	186	165	203
Wyoming	22	24	16	2	42	3,051	1,875	52	4,978	127	117	26	119
Other States	29	1,145	293	372	1,810	301,684	72,493	58,160	432,337	263	247	156	239
Total	2,514	15,878	7,697	768	24,343	4,062,909	1,849,478	126,299	6,038,686	256	240	164	248

TABLE 14.—*Gold, silver, and miscellaneous metal mines: Number of man-hours of labor and number killed and injured, by States, during the year ended Dec. 31, 1931*

State	Man-hours of labor				Number killed				Number injured				Widows	Orphans
	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total		
Alaska	1,833,840	3,800,728		5,634,568	4			4	81	124		205		
Arizona	1,076,508	667,112	18,456	1,462,076					50	15		65		
California	5,774,628	3,156,602	209,656	9,140,886	13			13	803	156	9	968	7	5
Colorado	3,755,668	1,046,752	31,720	4,034,140	9			9	432	117	5	554	3	8
Idaho	4,944,963	1,333,523	48,512	6,326,998	6			6	408	66	1	475	3	2
Montana	638,680	203,110	3,856	845,646	1			1	41	3		44	1	8
Nevada	2,218,312	541,040	30,840	2,790,192	3			3	148	26	3	177	1	
New Mexico	1,471,672	457,528	240	1,929,440	4			3	56	15		71	2	3
Oregon	250,369	223,160	12,560	486,089					4	21		25		
South Dakota	1,973,544	1,804,864	15,024	3,793,432	4	1		5	110	45		155	3	3
Utah	5,344,130	1,156,528	24,600	6,525,258	9	1		10	765	46		811	6	9
Virginia	500,791	76,850	155,100	732,741					40	5	3	48		
Washington	305,192	90,784	25,152	421,128					22	3		25		
Wyoming	23,908	15,000	416	39,324										
Other States	2,482,577	615,457	572,770	3,670,804	4			4	159	37	6	202	2	7
Total	32,594,782	14,889,038	1,148,902	48,632,722	56	2		58	3,119	679	27	3,825	28	45

TABLE 15.—*Iron mines: Men employed and days of labor, by States, during the year ended Dec. 31, 1931*

State	Number of mines	Men employed				Days of labor				Average days active			
		Underground	Surface	Opencut	Total	Underground	Surafce	Opencut	Total	Underground	Surface	Opencut	Total
Alabama	14	2,388	841	237	3,466	473,264	177,850	33,167	684,281	198	211	140	197
Michigan	54	4,932	2,372	254	7,558	962,708	482,609	48,239	1,493,556	195	203	190	198
Minnesota	78	3,153	1,467	3,292	7,912	686,407	313,992	673,750	1,674,149	218	214	205	212
New Jersey	5	477	209		686	67,609	27,626		95,235	142	132		139
New York	5	296	159	5	460	53,485	27,900	350	81,735	181	175	70	178
Other States	45	622	416	666	1,704	151,896	104,218	122,630	378,744	244	251	184	222
Total	201	11,868	5,464	4,454	21,786	2,395,369	1,134,195	878,136	4,407,700	202	208	197	202

TABLE 16.—*Iron mines: Number of man-hours of labor and number killed and injured, by States, during the year ended Dec. 31, 1931*

State	Man-hours of labors				Number killed				Number injured				Widows	Orphans
	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total		
Alabama	4,479,876	1,729,560	331,670	6,541,106	9			9	110	15	9	134	9	13
Michigan	7,760,580	4,427,070	464,503	12,652,153	7	1		8	173	26		199	6	9
Minnesota	5,494,581	2,973,229	6,757,036	15,224,846	3		1	4	91	20	68	179	4	7
New Jersey	540,872	237,448		778,320	1	1		2	58	1		59	1	3
New York	428,386	249,226	3,500	681,112	1			1	104	9		113	1	7
Other States	1,221,018	953,508	1,068,962	3,243,488	3		1	4	52	11	27	90	2	4
Total	19,925,313	10,570,041	8,625,671	39,121,025	24	2	2	28	588	82	104	774	23	43

Lead and zinc mines (Mississippi Valley States).—There was no change in the frequency rate of nonfatal injuries at lead and zinc mines in the Mississippi Valley States in 1931; an increase was reported in the rate for fatalities. According to returns from operating companies, accidents caused 10 deaths and 689 nonfatal injuries among employees; these figures represent a fatality rate of 1.06 and an injury rate of 72.81 for each million man-hours worked. A total of 9,463,502 man-hours of exposure or employment was shown by the reports, a reduction of about 36 percent in volume of work compared with the previous year. The period of operation averaged 189 days or 1,533 hours per man. The average number of men working at the mines during the year was 6,175, about three fourths as many as in 1930. Missouri, Oklahoma, and Kansas employed the largest number of men at lead and zinc mines in 1931, as in other years, and reports from mines in these States showed accident-frequency rates for nonfatal injuries of 54.43, 112.98, and 91.11 respectively, per million man-hours of exposure.

Nonmetallic mineral mines.—This group, which includes all mines except those producing coal, metal, or stone, reduced their nonfatal-accident rate in 1931 and increased their rate for fatalities. The injury rate per million man-hours of exposure was 46.88 and the fatality rate 0.61. The actual number of accidents included 11 deaths and 841 nonfatal lost-time injuries. An average of 8,949 men was employed during a period of 227 days, the number of employees being 1,613 less than in 1930 and the period of activity 37 days less per man. A total exposure of 17,941,296 man-hours was reported by the operating companies; the volume of work averaged 2,005 hours per man during the year. Table 21 shows the number and cause of accidents at the mines as reported by the companies.

TABLE 17.—*Lead and zinc mines* [1] *(Mississippi Valley): Men employed and days of labor, by States, during the year ended Dec. 31, 1931*

State	Number of mines	Men employed				Days of labor				Average days active			
		Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total
Illinois	10	191	31	14	236	23,467	3,912	1,330	28,709	123	126	95	122
Kansas	27	1,068	185	----	1,253	144,357	23,024	----	167,381	135	124	----	134
Kentucky	10	144	70	----	214	23,191	10,599	----	33,790	161	151	----	158
Missouri	16	1,991	199	----	2,190	413,291	36,868	----	450,159	208	185	----	206
Oklahoma	28	1,576	132	----	1,708	309,450	26,887	----	336,337	196	204	----	197
Wisconsin	4	100	27	----	127	26,055	6,865	----	32,920	261	254	----	259
Other States	5	309	118	20	447	84,195	30,439	6,180	120,814	272	258	309	270
Total	100	5,379	762	34	6,175	1,024,006	138,594	7,510	1,170,110	190	182	221	189

[1] Includes fluorspar mines in Illinois and Kentucky.

TABLE 18.—*Lead and zinc mines* [1] *(Mississippi Valley): Number of man-hours of labor and number killed and injured, by States, during the year ended Dec. 31, 1931*

State	Man-hours of labor				Number killed [2]		Number injured [3]			Widows	Orphans
	Underground	Surface	Opencut	Total	Underground	Total	Underground	Surface	Total		
Illinois	187,736	31,296	10,640	229,672	1	1	7	1	8	1	----
Kansas	1,154,856	184,192	----	1,339,048	5	5	115	7	122	2	4
Kentucky	200,692	95,691	----	296,383	1	1	14	1	15	1	----
Missouri	3,306,328	294,944	----	3,601,272	1	1	188	8	196	1	----
Oklahoma	2,475,600	215,096	----	2,690,696	1	1	284	20	304	----	----
Wisconsin	234,495	61,785	----	296,280	----	----	21	2	23	----	----
Other States	686,760	273,951	49,440	1,010,151	1	1	19	2	21	1	----
Total	8,246,467	1,156,955	60,080	9,463,502	10	10	648	41	689	1	4

[1] Includes fluorspar mines in Illinois and Kentucky.
[2] None killed at surface or in opencut mines.
[3] None injured at opencut mines.

TABLE 19.—*Nonmetallic mineral mines: Men employed and days of labor, by States, during the year ended Dec. 31, 1931*

State	Number of mines	Men employed				Days of labor				Average days active			
		Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total
California	59	314	104	133	551	78,398	27,683	28,988	135,069	250	266	218	245
Florida	14		373	671	1,044		95,589	150,733	246,322		256	225	236
Georgia	9	12	38	80	130	2,620	11,508	20,028	34,156	218	303	250	263
Iowa	7	102	23	21	146	15,961	4,327	3,801	24,089	156	188	181	165
Michigan	7	114	51	47	212	23,192	12,546	9,710	45,448	203	246	207	214
Missouri	9	29	158	174	361	5,699	46,825	47,002	99,526	197	296	270	276
New York	25	705	158	33	896	147,068	39,949	4,467	191,484	209	253	135	214
North Carolina	15	76	54	183	313	16,468	12,465	48,038	76,971	217	231	263	246
Pennsylvania	10	34	9	19	62	3,730	2,140	3,978	9,848	110	238	209	159
Tennessee	10	53	278	344	675	11,448	69,378	64,385	145,211	216	250	187	215
Texas	13	17	1,039	119	1,175	2,271	372,310	28,866	403,447	134	358	243	343
Utah	14	96	47	41	184	22,705	10,422	5,224	38,351	237	222	127	208
Virginia	8	94	459	162	715	21,422	95,713	33,274	150,409	228	209	205	210
Other States	128	950	512	1,023	2,485	198,550	103,104	127,143	428,797	209	201	124	173
Total	328	2,596	3,303	3,050	8,949	549,532	903,959	575,637	2,029,128	212	274	189	227

TABLE 20.—*Nonmetallic mineral mines: Number of man-hours of labor and number killed and injured, by States, during the year ended Dec. 31, 1931*

State	Man-hours of labor				Number killed				Number injured				Widows	Orphans
	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total	Underground	Surface	Opencut	Total		
California	627,384	224,887	238,360	1,090,631	1			1	72	14	12	98	1	
Florida		951,944	1,515,489	2,467,433			1	1		58	31	89	1	1
Georgia	26,200	115,080	200,460	341,740						3	8	11		
Iowa	127,688	34,726	30,408	192,822					9	2		11		
Michigan	198,622	112,914	96,330	407,866					15	3	3	21		
Missouri	45,592	374,600	382,700	802,892					1		6	7		
New York	1,245,935	349,782	41,135	1,636,852	1			1	52	8	3	63	1	
North Carolina	156,280	122,850	450,380	729,510					16	9	27	52		
Pennsylvania	29,840	21,400	36,958	88,198					1			1		
Tennessee	114,480	693,780	582,350	1,390,610					4	13	15	32		
Texas	18,168	3,091,805	261,721	3,371,694		1		1	2	154	8	164	1	1
Utah	181,640	83,376	45,936	310,952	1			1	18	2	2	22	1	1
Virginia	182,379	825,841	296,698	1,304,918					5	46	13	64		
Other States	1,724,110	930,146	1,150,922	3,805,178	5	1		6	104	37	65	206	4	6
Total	4,678,318	7,933,131	5,329,847	17,941,296	8	2	1	11	299	349	193	841	9	9

TABLE 21.—*All mines: Fatalities and injuries, classified by kind of mine and severity of injury, during the year ended Dec. 31, 1931*

Kind of mine and severity of injury	Underground																	Shaft						
	Fall of rock or ore from roof or wall	Rock or ore while loading at working face	Hand tools	Explosives	Haulage	Falling down chute, winze, raise, or stope	Run of ore from chute or pocket	Drilling	Electricity	Machinery	Mine fires	Suffocation from natural gases	Inrush of water	Stepping on nail	Handling material (other than rock or ore)	Other causes	Total, underground	Falling down shaft	Objects falling down shaft	Breaking of cables	Overwinding	Skip, cage, or bucket	Other causes	Total, shaft
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15a	15b		16	17	18	19	20	21	
Killed:																								
Copper	16	1	1	6	5	3		1								2	35	5	1			7		13
Gold, silver, and miscellaneous metal	26			3	2	10	3					2				1	47	1	2	2		3	1	9
Iron	12	1		4	2	2			1								22	1				1		2
Lead and zinc (Mississippi Valley)	6															1	7	1	1					2
Nonmetallic mineral	5			2												1	8	1						1
Total	65	2	1	15	9	15	3	1	1			2				5	119	9	4	2		11	1	27
Permanent total																								
Copper	1			1													2							
Gold, silver, and miscellaneous metal	3			1	1	1	1										7					1	1	2
Iron				2													2							
Lead and zinc (Mississippi Valley)																								
Nonmetallic mineral																								
Total	4			4	1	1	1										11					1	1	2
Permanent partial:																								
Copper	9	3	1	2	9	1	4	1						1		5	36		2			2	1	5
Gold, silver, and miscellaneous metal	22	12	16	5	10	2		5		3					4	5	84						4	4
Iron	2	2	2		12		3	1		6					5	8	41						1	1
Lead and zinc (Mississippi Valley)	4	13	1	2	15	4	1	1		2					1	10	54							
Nonmetallic mineral	2	1						2									5							
Total	39	31	20	9	46	7	8	10		11				1	10	28	220		2			2	6	10

Temporary:																							
Copper	507	224	265	22	213	120	96	128	4	14	----	1	----	64	91	278	2,027	9	24	1	----	19	37	90
Gold, silver, and miscellaneous metal	659	318	304	36	289	226	78	281	9	47	----	11	----	77	198	417	2,950	11	13	3	----	28	17	72
Iron	90	62	33	2	57	22	25	56	8	28	----	----	----	4	50	83	520	----	7	----	----	8	9	24
Lead and zinc (Mississippi Valley)	77	131	17	3	109	23	8	49	6	2	----	----	----	12	29	112	578	3	6	----	----	1	6	16
Nonmetallic mineral	44	66	27	3	46	11	1	23	1	4	----	----	----	4	13	46	289	----	----	----	1	4	----	5
Total	1,377	801	646	66	714	402	208	537	28	95	----	12	----	161	381	936	6,364	23	50	4	1	60	69	207
Total nonfatal:																							
Copper	517	227	266	25	222	121	100	129	4	14	----	1	----	65	91	283	2,065	9	26	1	----	21	38	95
Gold, silver, and miscellaneous metal	684	330	320	42	300	229	79	286	9	50	----	11	----	77	202	422	3,041	11	13	3	----	29	22	78
Iron	92	64	35	4	69	22	28	57	8	34	----	----	----	4	55	91	563	----	7	----	----	8	10	25
Lead and zinc (Mississippi Valley)	81	144	18	5	124	27	9	50	6	4	----	----	----	12	30	122	632	3	6	----	----	1	6	16
Nonmetallic mineral	46	67	27	3	46	11	1	25	1	4	----	----	----	4	13	46	294	----	----	----	1	4	----	5
Total	1,420	832	666	79	761	410	217	547	28	106	----	12	----	162	391	964	6,595	23	52	4	1	63	76	219
Total fatal and nonfatal:																							
Copper	533	228	267	31	227	124	100	130	4	14	----	1	----	65	91	285	2,100	14	27	1	----	28	38	108
Gold, silver, and miscellaneous metal	710	330	320	45	302	239	82	286	9	50	----	13	----	77	202	423	3,088	12	15	5	----	32	23	87
Iron	104	65	35	8	71	24	28	57	9	34	----	----	----	4	55	919	585	1	7	----	----	9	10	27
Lead and zinc (Mississippi Valley)	87	144	18	5	124	27	9	50	6	4	----	----	----	12	30	123	639	4	7	----	----	1	6	18
Nonmetallic mineral	51	67	27	5	46	11	1	25	1	4	----	----	----	4	13	47	302	1	----	----	1	4	----	6
Total	1,485	834	667	94	770	425	220	548	29	106	----	14	----	162	391	969	6,714	32	56	6	1	74	77	246

TABLE 21.—*All mines: Fatalities and injuries, classified by kind of mine and severity of injury, during the year ended Dec. 31, 1931*—Con.

Kind of mine and severity of injury	Surface											Opencut												Grand total
	Mine cars, mine locomotives, or aerial trams	Railway cars and locomotives	Run or fall of ore in or from ore bins	Falls of persons	Stepping on nail	Hand tools	Electricity	Machinery	Handling materials	Other causes	Total, surface	Falls or slides of rock or ore	Explosives	Haulage	Power shovels	Falls of persons	Falls of derricks, booms, etc.	Run or fall of ore in or from ore bins	Machinery	Electricity	Hand tools	Handling materials	Other causes	Total, opencut	
	22	23	24	25	26	27	28	29	30a	30b		31	32	33	34	35	36	37	38	39	40	41a	41b		
Killed:																									
Copper		1							1	1	3														51
Gold, silver, and miscellaneous metal								1		1	2														58
Iron									1	1	2	2													28
Lead and zinc (Mississippi Valley)																							2	2	9
Nonmetallic mineral	1							1			2												1	1	12
Total	1	1						2	2	3	9	2											1	3	158
Permanent total:																									
Copper																									2
Gold, silver, and miscellaneous metal				1				1			2														11
Iron																									2
Lead and zinc (Mississippi Valley)																									
Nonmetallic mineral																									
Total				1				1			2														15
Permanent partial:																									
Copper	1	1		3				2		1	8	1		1					1				2	5	54
Gold, silver, and miscellaneous metal	2			2		1		7		2	14										1			1	103
Iron		1				1		2		1	5		1			1			3		1		2	8	55
Lead and zinc (Mississippi Valley)								2	1		3														57
Nonmetallic mineral								3	1	2	6		1	2	2	1			5			1		12	23
Total	3	2		5		2		16	2	6	36	1	2	3	2	2			9		2	1	4	26	292

Temporary:																									
Copper	16	10	10	54	10	38	3	8	25	65	239	33	3	11	9	29	5	.....	8	2	10	31	27	168	2,524
Gold, silver, and miscellaneous metal	34	3	8	79	9	91	10	67	111	251	663	8	.....	.....	5	2	.....	.....	.....	.....	2	6	3	26	3,711
Iron	5	3	2	10	4	9	1	7	20	16	77	10	3	12	3	8	.....	.....	7	1	10	27	15	96	717
Lead and zinc (Mississippi Valley)	1	.....	2	1	1	4	.....	2	4	23	38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	632
Nonmetallic mineral	7	8	4	36	13	47	6	55	72	95	343	29	5	11	6	16	4	2	12	1	13	32	50	181	818
Total	63	24	26	180	37	189	20	139	232	450	1,360	80	11	34	23	55	9	2	27	4	35	96	95	471	8,402
Total, nonfatal:																									
Copper	17	11	10	57	10	38	3	10	25	66	247	34	3	12	9	29	5	.....	9	2	10	31	29	173	2,580
Gold, silver, and miscellaneous metal	36	3	8	82	9	92	10	75	111	253	679	8	.....	.....	5	2	.....	.....	.....	.....	3	6	3	27	3,825
Iron	5	4	2	10	4	10	1	9	20	17	82	10	4	12	3	9	.....	.....	10	1	11	27	17	104	774
Lead and zinc (Mississippi Valley)	1	.....	2	1	1	4	.....	4	5	23	41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	689
Nonmetallic mineral	7	8	4	36	13	47	6	58	73	97	349	29	6	13	8	17	4	2	17	1	13	33	50	193	841
Total	66	26	26	186	37	191	20	156	234	456	1,398	81	13	37	25	57	9	2	36	4	37	97	99	497	8,709
Total, fatal and nonfatal:																									
Copper	17	12	10	57	10	38	3	10	26	67	250	34	3	12	9	29	5	.....	9	2	10	31	29	173	2,631
Gold, silver, and miscellaneous metal	36	3	8	82	9	92	10	76	111	254	681	8	.....	.....	5	2	.....	.....	.....	.....	3	6	3	27	3,883
Iron	5	4	2	10	4	10	1	9	21	18	84	12	4	12	3	9	.....	.....	10	1	11	27	17	106	802
Lead and zinc (Mississippi Valley)	1	.....	2	1	1	4	.....	4	5	23	41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	698
Nonmetallic mineral	8	8	4	36	13	47	6	59	73	97	351	29	6	13	8	17	4	2	17	1	13	33	51	194	853
Total	67	27	26	186	37	191	20	158	236	459	1,407	83	13	37	25	57	9	2	36	4	37	97	100	500	8,867

COMPARATIVE ACCIDENT RATES FROM CHIEF CAUSES OF ACCIDENTS IN PRINCIPAL MINING STATES

Although mining operations of some kind are conducted in nearly all States of the Union, the number of men employed in most States is relatively small. According to the returns for 1931, only 9 States employed as many as 2,000 men in underground mines of the classes included in this publication and only 7 States employed 400 men in opencut mining. Accident rates for the chief causes of nonfatal accidents at mines in these States differ not only in the totals for all classes of accidents but also for certain types of accidents. A State having favorable rates for certain kinds of accidents may have excessively high rates for other classes. In the present discussion the rates for each of the principal metal-mining States will be compared with the United States average; the comparison will be based upon nonfatal accidents only, because the figures for nonfatal injuries, being larger than those for fatalities, are more representative of actual conditions and less affected by small changes in the number of accidents.

Mining methods differ in various localities and mines because of natural differences in the type and position of ore bodies. To some extent these explain the fact that certain classes of accidents are more or less frequent in different mines. It is impossible to state how much of the variation in the accident rates of different companies is due to natural conditions over which the company has only limited control. The present discussion, therefore, is limited to an attempt to point out frequency rates for different classes of accidents as actually shown by the operators' reports. Regardless of what the accident rates are for any large group of mines, it is certain that many individual companies within the group may further reduce their rates.

Alabama.—The frequency rate for accidents underground in the mines of Alabama was more favorable in 1931 than the average for the United States. Alabama had a lower rate than the average for each of the seven leading causes of accidents in metal mines.

Arizona.—The frequency of nonfatal injuries underground at mines in Arizona, based upon the number of man-hours of exposure of underground employees, was less and therefore more favorable than the average for the United States. The State's advantage is chiefly in its lower accident rates from loading ore at the face, hand tools, haulage, drilling, and falling down chutes, raises, and stopes. Opencut mining in Arizona had a higher injury rate than the country's average due chiefly to persons falling, machinery, and hand tools.

California.—Accident frequency among underground workers was relatively higher in California than in the country as a whole. The higher rate in 1931 was not limited to any one class of accidents but was distributed generally among the principal causes of accidents in mines.

TABLE 22.—*Metal mines; nonfatal-injury rates per million man-hours worked underground and in opencut mines, by principal causes, for important metal-mining States, during the year ended Dec. 31, 1931*

UNDERGROUND

Cause	State									
	Michigan	Arizona	Montana	California	Minnesota	Idaho	Utah	Alabama	Missouri	United States
Fall of rock or ore from roof or wall	12.69	15.39	20.06	29.15	4.78	21.25	32.62	2.46	5.00	15.59
Rock or ore while loading at working face	7.02	2.93	9.01	14.21	.53	11.10	8.07	2.01	9.41	9.13
Hand tools	2.77	4.61	18.93	15.95	.53	9.57	13.73	3.12	1.76	7.31
Haulage	5.25	6.39	8.11	17.69	1.95	5.36	15.62	6.70	13.82	8.35
Drilling	4.04	3.66	4.84	11.89	.35	3.64	13.91	.45	4.71	6.00
Falling down chute, winze, raise, or stope	3.26	3.35	4.06	15.81	.89	4.59	12.88	.22	4.71	4.50
Handling materials (other than rock or ore)	2.34	4.82	2.93	9.86	2.48	6.51	9.79	1.56	5.88	4.29
All causes (underground)	58.37	60.40	82.02	140.37	19.13	82.32	137.52	24.55	57.06	74.80

OPENCUT MINES

Cause	Minnesota	Utah	Florida	Kentucky	Missouri	Arizona	New Mexico	United States
Falls or slides of rock or ore	0.57	3.20	0.66	10.06	9.60	4.21	15.86	4.12
Haulage	1.01	2.29	-------	15.08	8.23	2.11	3.73	1.88
Falls of persons	1.15	2.29	3.30	7.54	1.37	7.37	8.40	2.90
Machinery	1.15	.46	2.64	15.08	4.11	4.21	2.80	1.83
Hand tools	1.01	-------	1.98	5.03	2.74	3.16	3.73	1.88
Handling materials	3.02	.92	1.32	7.54	5.48	5.26	14.00	4.93
All causes (openpit)	9.77	9.61	20.46	77.94	41.14	41.05	74.65	25.26

Florida.—Mines in Florida are all nonmetallic mineral mines but are included in this publication because such mines in Florida and other States comprise only a small part of the mining industry in general. The properties in Florida are worked largely by opencut methods, and as a group they gave the State a favorable safety record in 1931. Accidents caused by machinery and falls of persons were more frequent than the average for such accidents in all States, but the accident rates in Florida for falls or slides of rock or overburden, haulage, and handling materials were better than the average.

Idaho.—The rate for Idaho was somewhat higher than the country's average, due mainly to accidents from falls of rock or ore from roof or wall, loading, hand tools, and handling materials. In 1931 the State enjoyed favorable injury rates for haulage and drilling.

Kentucky.—Opencut mines in Kentucky had an accident rate less favorable than the country's average. The higher rate was shown by the operators' returns to be distributed generally among the principal causes of accidents.

Michigan.—Accident frequency underground in the mines of Michigan was more favorable than the average for the United States. All of the leading causes of accidents had lower rates than in the country as a whole.

Minnesota.—Underground mines in Minnesota had a particularly favorable accident rate per million man-hours of exposure of underground employees. All of the leading causes of accidents showed lower frequency rates in the State than throughout the country.

Opencut mining in Minnesota was also characterized by a better record than the general average for that class of mines in the United States; the rate was favorable to Minnesota in each of the principal classes of accidents.

Missouri.—The nonfatal-injury rate for underground mining in Missouri was better than that for the United States as a whole. The State rate was especially favorable for accidents from falls of roof or wall, hand tools, and drilling but less favorable than the general average for accidents from haulage and handling materials. On the other hand, the accident-frequency rate for opencut mining in Missouri was higher than the general average for the United States in each of the principal causes of accidents at opencut mines except falls of persons.

Montana.—Montana's rate for nonfatal injuries underground was slightly higher than the country's average, the higher rate being caused by falls of rock from roof or wall and hand tools. The State rate was more favorable than the general average for accidents due to drilling and to handling materials.

Utah.—The underground injury rate for Utah was higher than the average for the United States, the higher rate in Utah being distributed generally among the principal classes of accidents; however, the State rate for accidents while loading at the working face was more favorable than the general rate for accidents of the same type. Opencut mining in Utah enjoyed a strikingly favorable safety record in 1931; the frequency of accidents at such mines was only a little over a third as high as the United States average for opencut mining.

ACCIDENTS CLASSIFIED BY MINING METHODS

The classification of mining methods employed in this bulletin is that prepared by the Mining Division of the Bureau of Mines and used by that division in its studies of the relative efficiency of various mining methods from the standpoint of productivity and costs. The classification was used in this series of statistical bulletins for the first time in the bulletin covering the calendar year 1929; it is as follows:

1. Open-stope, including the room-and-pillar method and sublevel stoping.
2. Shrinkage.
3. Cut-and-fill.
4. Square-set.
5. Block caving.
6. Sublevel caving.
7. Top slicing.
8. Opencut with power shovel.
9. Opencut with power scraper.
10. Opencut, hand loading only.
11. Hydraulicking.
12. Dredging.

From the point of view of the numerous companies and States represented and the number of men employed in the mines the most widely used operating method in metal mines in the United States is the open-stope method, including room-and-pillar and sublevel stoping. Next in importance in number of persons employed is the square-set method. Ranking next among underground methods of mining are top slicing, shrinkage, block caving, cut-and-fill, and sublevel caving.

Figures for 1931 showed that the combined accident-frequency rate for fatalities and injuries in underground mining was most favorable for top slicing and that the next lowest accident rate was that for sublevel caving. The highest rate was reported by mines using square-set methods, while shrinkage methods showed a rate second from the highest.

It should be repeated in this connection that a mining company is not free to choose any method of mining that officials may prefer; it is not free to adopt any method solely from the standpoint of safety. The method to be used is determined mainly by the type of deposit, the character and value of the ore, and the possibility of extracting the ore at a price economically sound.

Table 23 shows the number of employees in mines using each of the various methods and the comparative accident-frequency rates of these mines for fatalities and nonfatal lost-time injuries. In compiling this table each mine was classified according to its principal mining method, as shown in the company report to the Bureau of Mines.

TABLE 23.—*Metal-mine accident data, grouped by mining methods, during the year ended Dec. 31, 1931, for selected companies* [1]

Method of mining	Number of mines	Number of States	Average days active	Days of labor performed	Men employed	Man-hours of labor performed	Number killed	Number injured	Rate per million man-hours: Killed	Rate per million man-hours: Injured
Open stope including room-and-pillar and sublevel stoping	153	28	217	3,287,522	15,166	27,332,930	44	2,240	1.61	81.95
Shrinkage	26	13	224	477,449	2,135	3,819,592	5	387	1.31	101.32
Cut-and-fill	13	7	274	559,406	2,038	4,475,248	11	254	2.46	56.76
Square-set	42	8	296	2,148,912	7,250	17,191,296	34	1,849	1.98	107.55
Block caving	8	6	260	285,496	1,100	2,300,038	3	112	1.30	48.69
Sublevel caving	20	4	207	454,081	2,189	3,669,998	------	116	------	31.61
Top slicing	37	4	222	1,162,600	5,237	9,300,800	9	209	.97	22.47
Opencut with power shovel	65	15	224	1,539,750	6,874	14,078,795	1	290	.07	20.60
Opencut, hand loading only	8	8	238	74,357	312	681,062	------	34	------	49.92
Total	372	93	236	9,989,573	42,301	82,849,759	107	5,491	1.29	66.28

[1] Underground and opencut only. No reports used when less than 25 men were employed.

PLACER MINING

Reports received by the United States Bureau of Mines for 1931 covered placer mines that employed 3,737 men. More than one third of these men were employed in dredging operations, chiefly in Alaska and California; about one fourth of the total number worked at placers using hydraulicking methods in Alaska, California, Idaho, and Oregon; and approximately one sixth were employed underground, principally in Alaska, California, Idaho, and Oregon. The remainder worked at surface shops and yards.

The lowest accident rate in 1931 was for hydraulicking and the next lowest for dredging. Underground placer mining reported the second highest rate and surface shops and yards the highest.

Reports from placer properties during the past 5 years have indicated a higher accident rate for shop and yard employees than for surface employees at all kinds of mines. On the other hand, operations underground at placers have shown an accident rate about twice as favorable as the general average for underground mining. On the whole, the rates for all classes of work at placers have been decidedly more favorable than the corresponding average rates for the metal-mining industry as a whole.

Different causes of accidents vary in importance from year to year. In 1931, at underground placers, haulage accidents caused more injuries than any other single hazard, although hand tools are usually the leading cause. Reports from dredging operations revealed hand tools and falls of persons as the principal causes of accidents. In hydraulicking, hand tools and cave of bank were the chief causes of injuries.

TABLE 24.—*Placer mines: Men employed, days of labor performed, and number killed and injured during the years ended Dec. 31, 1930 and 1931*

	1930					1931				
	Underground	Surface	Dredging	Hydraulicking	Total	Underground	Surface	Dredging	Hydraulicking	Total
Men employed	622	725	1,465	866	3,678	657	671	1,452	957	3,737
Days of labor	113,681	158,033	397,093	133,974	802,781	110,200	132,356	361,418	139,205	743,179
Number of 300-day workers	379	527	1,324	446	2,676	367	441	1,205	464	2,477
Average days active	183	218	271	155	218	168	197	249	145	199
Number killed	5	1	1	1	8					
Number injured	42	112	120	42	316	42	83	110	21	256
Killed per thousand 300-day workers	13.19	1.90	0.76	2.24	2.99					
Injured per thousand 300-day workers	110.82	212.52	90.63	94.17	118.09	114.44	188.21	91.29	45.26	103.35

TABLE 25.—*Placer mines: Severity of injury during the years ended Dec. 31, 1930 and 1931*

	1930						1931					
	Killed	Permanent total disability	Permanent partial disability	Temporary	Total nonfatal	Grand total	Killed	Permanent total disability	Permanent partial disability	Temporary	Total nonfatal	Grand total
Underground	5			42	42	47			2	40	42	42
Surface	1		2	110	112	113				83	83	83
Dredging	1		2	118	120	121			1	109	110	110
Hydraulicking	1			42	42	43				21	21	21
Total	8		4	312	316	324			3	253	256	256

TABLE 26.—*Placer mines: Number killed and injured by causes, during the years ended Dec. 31, 1930 and 1931*

Cause	1930		1931	
	Killed	Injured	Killed	Injured
Fall of rock or ore from roof or wall		4		5
Rock or ore while loading at working face		5		2
Hand tools		8		5
Mine fires	5	3		
Haulage		5		11
Falling down chute, winze, raise, or stope		5		2
Run of ore from chute or pocket				1
Drilling		1		4
Machinery		1		2
Stepping on nail		3		1
Handling materials (other than rock or ore)				4
Other causes		4		3
Total, underground	5	39		40
Falling down shaft				
Objects falling down shaft				
Skip, cage, or bucket		3		2
Other causes				
Total, shaft		3		2
Mine cars, mine locomotives, or aerial trams		2		1
Railway cars and locomotives				
Falls of persons		25		9
Stepping on nail		10		1
Hand tools		14		23
Electricity		3		1
Machinery		12		7
Handling materials	1	6		10
Other causes		40		31
Total, surface	1	112		83
Machinery		25		17
Electricity		5		2
Boiler explosions or bursting steam pipes				1
Falls of persons		15		19
Hand tools		30		20
Handling materials		12		11
Other causes	1	33		40
Total, dredging	1	120		110
Cave of bank	1	2		3
Explosives				
Hydraulic giants		3		
Falls of persons		6		2
Rock while handling		8		1
Hand tools		7		5
Machinery		5		1
Handling materials (other than rock or ore)		2		1
Other causes		9		8
Total, hydraulicking	1	42		21
Grand total	8	316		256

COMPARATIVE ACCIDENT RATES FOR 1931 AND PREVIOUS YEARS

Tables 27 and 28 present comparative accident rates for metal mines for 1931 and earlier years. The rates given in these tables show the number of accidents per thousand 300-day workers. The preparation of rates on the basis of man-hours of exposure was not practicable as figures had not been compiled to show the number of man-hours worked previous to 1931.

Table 29, covering the calendar year 1931, contains comparative accident rates for metal mining and other branches of the mineral industry in the United States.

TABLE 27.—*All mines: Number of fatalities and injuries and fatality and injury rates per thousand 300-day workers, classified by severity of injury, 1922–31*

NUMBER OF ACCIDENTS

Severity of injury	Total 1922–26	1927	1928	1929	1930	1931	Total 1927–31
Fatal	1,930	352	273	350	271	158	1,404
Permanent total [1]	80	11	19	22	22	15	89
Permanent partial [2]	2,257	517	550	455	481	292	2,295
Temporary [3]	155,906	24,605	21,914	22,615	15,091	8,398	92,623
Total	160,173	25,485	22,756	23,442	15,865	8,863	96,411

RATES PER THOUSAND 300-DAY WORKERS

Fatal	3.29	3.10	2.50	3.03	2.92	2.53	2.85
Permanent total [1]	.14	.09	.17	.19	.24	.24	.18
Permanent partial [2]	3.85	4.56	5.03	3.94	5.18	4.68	4.65
Temporary [3]	266.10	216.89	200.41	195.98	162.44	134.58	187.69
Total	273.38	224.64	208.11	203.14	170.78	142.03	195.37
Average number of 300-day workers per year	585,895	113,447	109,345	115,394	92,900	62,405	493,491

[1] Permanent total disability: Loss of both legs or arms, 1 leg and 1 arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

[2] Permanent partial disability: Loss of 1 foot, leg, arm, hand, or eye, 1 or more fingers, 1 or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

[3] Disability for more than remainder of day of accident.

TABLE 28.—*Number of men employed, days of labor performed, and number of men killed and injured at all mines (except coal mines) in the United States, 1911–31*

Year	Average days active	Men employed		Total shifts	Number killed		Number injured	
		Actual number	Equivalent in 300-day workers (calculated)		Total	Per thousand 300-day workers (calculated)	Total	Per thousand 300-day workers (calculated)
1911	282	165,979	156,088	46,826,573	695	4.45	26,577	170.27
1912	287	168,550	161,059	48,317,800	661	4.10	30,734	190.82
1913	288	191,276	183,594	55,077,855	683	3.72	32,971	179.59
1914	271	158,115	142,620	42,785,840	559	3.92	30,216	211.87
1915	280	152,118	141,997	42,599,015	553	3.89	35,295	248.56
Average for 5 years	282	167,208	157,072	47,121,417	630	4.01	31,159	198.37
1916	282	204,685	192,455	57,736,425	697	3.62	48,237	250.64
1917	287	200,579	192,085	57,625,811	852	4.44	46,286	240.97
1918	297	182,606	181,006	54,301,748	646	3.57	42,915	237.09
1919	279	145,262	134,871	40,461,350	468	3.47	31,506	233.60
1920	296	136,583	134,540	40,361,893	425	3.16	32,562	242.02
Average for 5 years	288	173,943	166,991	50,097,445	618	3.70	40,301	241.34
Average for 10 years	285	170,576	162,031	48,609,431	624	3.85	35,730	220,51
1921	238	93,929	74,509	22,352,702	230	3.09	18,604	249.69
1922	276	105,697	97,138	29,141,293	344	3.54	26,080	268.48
1923	297	123,279	121,866	36,559,805	367	3.01	33,563	275.41
1924	290	123,128	119,113	35,734,008	418	3.51	33,118	278.04
1925	293	126,713	123,908	37,172,359	371	2.99	35,132	283.53
Average for 5 years	281	114,549	107,307	32,192,033	346	3.23	29,299	273.04
Average for 15 years	284	151,933	143,790	43,136,965	531	3.69	33,586	233.58
1926	291	127,823	123,870	37,160,978	430	3.47	30,350	245.01
1927	284	119,699	113,447	34,033,963	352	3.10	25,133	221.54
1928	288	113,866	109,345	32,803,610	273	2.50	22,483	205.61
1929	292	118,735	115,394	34,618,120	350	3.03	23,092	200.11
1930	270	103,233	92,900	27,869,982	271	2.92	15,594	167.86
Average for 5 years	285	116,671	110,991	33,297,330	335	3.02	23,330	210.20
Average for 20 years	284	143,093	135,590	40,677,956	482	3.55	31,022	228.79
1931	231	80,940	62,405	18,721,486	158	2.53	8,709	139.56

TABLE 29.—*United States: Accident data, including rates for different branches of the mineral industry in 1931 per million man-hours*

Branch of mineral industry	Average days active	Men employed	Days of labor	Man-hours of labor	Number killed	Number injured	Rate per million man-hours	
							Killed	Injured
Coal mines	168	589,705	99,264,019	804,394,130	1,463	80,349	1.82	99.89
All metal mines	231	80,940	18,721,486	156,177,859	158	8,709	1.01	55.76
Copper	258	19,687	5,075,862	41,019,314	51	2,580	1.24	62.90
Gold, silver, and miscellaneous metal	248	24,343	6,038,686	48,632,722	58	3,825	1.19	78.65
Iron	202	21,786	4,407,700	39,121,025	28	774	.72	19.78
Lead and zinc (Mississippi Valley)	189	6,175	1,170,110	9,463,502	10	689	1.06	72.81
Nonmetallic mineral	227	8,949	2,029,128	17,941,296	11	841	.61	46.88
All quarries (including outside works)	224	69,200	15,526,503	133,750,124	61	5,427	.46	40.58
Cement rock	269	18,456	4,956,900	43,948,493	10	537	.23	12.22
Granite	220	9,439	2,077,279	16,678,464	6	1,110	.36	66.55
Limestone	201	28,233	5,676,936	48,559,283	34	2,639	.70	54.35
Marble	278	4,654	1,292,235	11,336,684	1	344	.09	30.34
Sandstone and bluestone	172	2,796	480,086	4,239,865	6	204	1.42	48.11
Slate	192	2,361	453,154	3,914,050	1	230	.26	58.76
Trap rock	181	3,261	589,913	5,073,285	3	363	.59	71.55
All quarries (excluding outside works)	198	33,221	6,578,450	56,280,488	50	3,390	.89	60.23
All quarries (outside works only)	249	35,979	8,948,073	77,469,636	11	2,037	.14	26.29
Metallurgical plants	299	28,938	8,641,868	70,373,642	16	1,393	.23	19.79
Ore dressing	260	8,867	2,309,645	18,934,699	6	439	.32	23.18
Smelters	315	11,993	3,778,420	30,411,110	6	601	.20	19.76
Auxiliary works	316	8,078	2,553,803	21,027,833	4	353	.19	16.79
All coke ovens	350	15,564	5,448,923	44,574,281	9	534	.20	11.98
Beehive	175[2]	1,095	191,224	1,609,295	1	58	.62	36.04
Byproduct	363	14,469	5,257,699	42,964,986	8	476	.19	11.08
Total	188	784,347	147,602,799	1,209,270,036	1,707	96,412	1.41	79.73